SECTION 33 52 10.01 00

SERVICE PIPING, POL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

This section defines the requirements for pipe, piping components, and valves as related to fuel distribution systems (non-aviation type). Provide the entire fuel distribution system as a complete and fully operational system. Size, select, construct, and install equipment and system components to operate together as a complete system. Substitutions of functions specified herein will not be acceptable. Coordinate the work of the system manufacturer's service personnel during construction, testing, calibration, and acceptance of the system. Design equipment and piping specified herein to handle a working pressure of 275 psig at 100 deg F. Equipment specified herein must be compatible with the fuel to be handled.

1.1.1 Related Sections

1.1.1.1 Welding

Welding activities for pipe and piping components must be in accordance with Section 33 52 90.01 20 WELDING FOR POL SERVICE PIPING.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API RP 1110	(2013) Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids or Carbon Dioxide
API RP 2003	(2008; 7th Ed) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
API RP 540	(1999; R 2004) Electrical Installations in Petroleum Processing Plants
API Spec 5L	(2012; ERTA 2015) Specification for Line Pipe
API Spec 6D	(2014; Errata 1-2 2014; Errata 3-5 2015; ADD 1 2015) Specification for Pipeline Valves
API Std 594	(2010) Check Valves: Flanged, Lug, Wafer and Butt-Welding

API Std 676 (2009) Positive Displacement Pumps - Rotary

AMERICAN WELDING SOCIETY (AWS)

AWS BRH (2007; 5th Ed) Brazing Handbook

ASME INTERNATIONAL (ASME)

ASME B1.1 (2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)

ASME B16.11 (2011) Forged Fittings, Socket-Welding and Threaded

ASME B16.21 (2011) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.3 (2011) Malleable Iron Threaded Fittings, Classes 150 and 300

ASME B16.34 (2013) Valves - Flanged, Threaded and Welding End

ASME B16.39 (2014) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

ASME B16.5 (2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B16.9 (2012) Standard for Factory-Made Wrought Steel Buttwelding Fittings

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2010) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B31.3 (2014) Process Piping

ASME B31.4 (2012) Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquid

ASME B40.100 (2013) Pressure Gauges and Gauge Attachments

ASME B40.200 (2008; R 2013) Thermometers, Direct Reading and Remote Reading

ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M (2014) Standard Specification for Carbon Steel Forgings for Piping Applications

ASTM A182/A182M (2015) Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged

	Fittings, and Valves and Parts for High-Temperature Service
ASTM A193/A193M	(2015) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2015) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A216/A216M	(2014; E 2015) Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A234/A234M	(2013; E 2014) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A269/A269M	(2014; E 2014) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A307	(2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A312/A312M	(2015) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A351/A351M	(2014) Standard Specification for Castings, Austenitic, for Pressure-Containing Parts
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A436	(1984; R 2011) Standard Specification for Austenitic Gray Iron Castings
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A733	(2013) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A743/A743M	(2013a; E 2014) Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant,

	for General Application
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B247	(2009) Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
ASTM B687	(1999; R 2011) Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples
ASTM D229	(2013) Rigid Sheet and Plate Materials Used for Electrical Insulation
ASTM D3308	(2012) PTFE Resin Skived Tape
ASTM D5677	(2005; R 2010) Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Pipe Fittings, Adhesive Bonded Joint Type, for Aviation Jet Turbine Fuel Lines
ASTM F1172	(1988; R 2015; E 2015) Standard Specification for Fuel Oil Meters of the Volumetric Positive Displacement Type
ASTM F436	(2011) Hardened Steel Washers
ASTM F844	(2007a; R 2013) Washers, Steel, Plain (Flat), Unhardened for General Use
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)	
IEEE 1100	(2005) Emerald Book IEEE Recommended Practice for Powering and Grounding Electronic Equipment
IEEE 142	(2007; Errata 2014) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-58	(1993; Reaffirmed 2010) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
NACE INTERNATIONAL (NACE)	
NACE SP0188	(1999; R 2006) Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2014) Motors and Generators
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2015) Flammable and Combustible Liquids Code
NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code
NFPA 77	(2014) Recommended Practice on Static Electricity
NFPA 780	(2014) Standard for the Installation of Lightning Protection Systems

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2000; E 2004) Shop, Field, and Maintenance Painting of Steel

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS3275	(2009; Rev C) Sheet, Acrylonitrile Butadiene (NBR) Rubber and Non-Asbestos Fiber Fuel and Oil Resistant
SAE J514	(2012) Hydraulic Tube Fittings

UNDERWRITERS LABORATORIES (UL)

UL FLAMMABLE & COMBUSTIBLE	(2012) Flammable and Combustible Liquids and Gases Equipment Directory

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submittals with an "S" designation following the "G" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29.01 00 SUSTAINABILITY REPORTING. Other designations following the "G" designation identify the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00.01 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Grounding and Bonding
Pipe Hangers and Supports

SD-03 Product Data

Carbon Steel Pipe; G, C
Stainless Steel Pipe; G, C
Fiberglass Reinforced Plastic (FRP) Pipe; G, C
Pressure Gauge; G, C
Flexible Ball Joint; G, C
Bellows Expansion Joint; G, C
Swing Type Check Valve; G, C
Wafer Type Check Valve; G, C
Ball Valve; G, C
Plug Valve (PTFE Sleeved Tapered Type); G, C
Plug Valve (Double Block and Bleed Type); G, C
Globe Valve; G, C
Pressure Relief Valve; G, C
Pressure\Vacuum Relief Valve; G, C
Foot Valve; G, C
Tank Overfill Prevention Valve; G, C
Rotary Pumps; G, C
Pump Control Panel; G, C
FRP Containment Sump; G, C

SD-06 Test Reports

Exterior Coating Holiday Test
Hydrostatic Test
Exterior Containment Piping Tests

SD-07 Certificates

Contractor Qualifications; G
Licensed Personnel
Demonstrations

SD-08 Manufacturer's Instructions

Flexible Ball Joint
Bellows Expansion Joint

SD-10 Operation and Maintenance Data

Provide O&M Data Package 4 in accordance with Section 01 78 23.01 00 OPERATION AND MAINTENANCE DATA, paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES.

Flexible Ball Joint; G, C
Bellows Expansion Joint; G, C
Swing Type Check Valve; G, C
Wafer Type Check Valve; G, C
Ball Valve; G, C
Plug Valve (PTFE Sleeved Tapered Type); G, C
Plug Valve (Double Block and Bleed Type); G, C
Globe Valve; G, C
Pressure Relief Valve; G, C
Pressure\Vacuum Relief Valve; G, C
Foot Valve; G, C
Tank Overfill Prevention Valve; G, C
Rotary Pumps; G, C

1.4 QUALITY ASSURANCE

1.4.1 Contractor Qualifications

Each installation Contractor must have successfully completed at least 3 projects of the same scope and the same size, or larger, within the last 6 years; demonstrate specific installation experience in regard to the specific system installation to be performed; have taken, if applicable, manufacturer's training courses on the installation of piping; and meet the licensing requirements in the state. For FRP pipe installation, certification by the FRP manufacturer as a qualified installer of their products is required. Submit a letter listing prior projects, the date of construction, a point of contact for each prior project, the scope of work of each prior project, and a detailed list of work performed providing in the letter evidence of prior manufacturer's training and state licensing.

1.4.2 Regulatory Requirements

1.4.2.1 Licensed Personnel

Pipe installers must be licensed/certified by the state when the state requires licensed installers.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6 PROJECT/SITE CONDITIONS

Fuel required for the testing, flushing and cleaning efforts, as specified in this section, will be provided and delivered by the Contractor. Do not flush, clean, or test any system with fuel or liquid not intended for final system operation. Fuel used in the system will remain the property of the Contractor.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Internal parts and components of equipment, piping, piping components, and valves that could be exposed to fuel during system operation must not be constructed of zinc coated (galvanized) metal, brass, bronze, or other copper bearing alloys. Do not install cast iron bodied valves in piping systems that could be exposed to fuel during system operation.

2.1.1 Standard Products

Provide materials and equipment that are standard products of a manufacturer regularly engaged in the manufacturing of such products; that are of a similar material, design and workmanship; and that have been in satisfactory commercial or industrial use for a minimum 2 years prior to bid opening. The 2 year period must include applications of the equipment and materials under similar circumstances and of similar size. Materials and equipment must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

2.1.2 Nameplates

Attach nameplates to all specified equipment, thermometers, gauges, and valves defined herein. List on each nameplate the manufacturer's name, address, component type or style, model or serial number, catalog number, capacity or size, and the system that is controlled. Construct plates of anodized aluminum or stainless steel . Install nameplates in prominent locations with nonferrous screws, nonferrous bolts, or permanent adhesive. Minimum size of nameplates must be 1 by 2.5 inches. Lettering must be the normal block style with a minimum 0.25 inch height. Accurately align all lettering on nameplates.

2.1.3 Gaskets

Provide gaskets that are factory cut from one piece of material. All gaskets must be compatible with the POL products used.

2.1.3.1 Nitrile Butadiene (Buna-N)

Provide Buna-N material that conforms to SAE AMS3275.

2.1.3.2 Acrylonitrile Butadiene Rubber (NBR)

Provide NBR material that conforms to SAE AMS3275.

2.2 ELECTRICAL COMPONENTS

2.2.1 General

Provide motors, motor starters, controllers, integral disconnects, contactors, controls, and control wiring with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00.01 00 INTERIOR DISTRIBUTION SYSTEM. Provide switches and devices necessary for controlling and protecting electrical equipment. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Controllers and contactors must have a maximum of 120-volt control circuits and must have auxiliary contacts for use with the controls provided. For packaged equipment, the manufacturer must provide controllers including the required monitors and timed restart.

2.2.2 Motors

Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor when operating at proper electrical system voltage. Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Provide polyphase, squirrel-cage medium induction motors, including motors that are part of a system, that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Motors must be rated for continuous duty with the enclosure specified. Motor duty requirements must allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque must be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.

Coordinate motor enclosure types with HEMP protection requirements (see Section 13 27 54.01 10 HEMP PROTECTION SUBSYSTEMS) for fuel forwarding pumps. VFDs should not drive any electrical equipment through a HEMP filter due to compatibility issues.

2.2.3 Motor Controllers

Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers may be provided to accomplish the same function. Use solid-state variable-speed controllers for motors rated 10 hp or less and adjustable frequency drives for larger motors. Provide variable frequency drives for motors as specified in Section 26 29 23.01 00 VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS.

2.2.4 Underground Wiring

Enclose underground electrical wiring in PVC coated conduit. Dielectrically isolate conduit at any steel storage tank connection.

2.2.5 Grounding and Bonding

Grounding and bonding shall be in accordance with NFPA 70, NFPA 77, NFPA 780, API RP 540, API RP 2003, IEEE 142, and IEEE 1100. Provide jumpers to overcome the insulating effects of gaskets, paints, or nonmetallic components.

2.3 FLANGED END CONNECTIONS

2.3.1 Flanges

Provide flanged end connections on equipment, fittings, piping, piping components, adapters, couplers,and valves that conform to ASME B16.5, Class 150.

2.3.1.1 Carbon Steel

Carbon steel flanges shall conform to ASTM A105/A105M.

2.3.1.2 Stainless Steel

Stainless steel flanges shall conform to ASTM A182/A182M, Grade F304 or F304L, forged type.

2.3.1.3 Aluminum

Aluminum flanges shall conform to ASTM B247, Alloy 6061-T6.

2.3.2 Flange Gaskets, Non-Isolating

Provide flange gaskets that are 1/8 inch thick and that conform to ASME B16.21, raised-face type unless otherwise indicated. Gaskets shall be constructed of Buna-N.

2.3.3 Flange Gaskets, Electrically Isolating

Flange gaskets shall conform to ASTM D229 and shall provide an electrical insulating material of 1000 ohms minimum resistance. Provide gasket material that is chemically compatible with the fuel to be handled.

Provide gaskets that are the full face type. Provide flanges that have a full surface 0.03 inch thick, spiral-wound mylar insulating sleeves between the bolts and the holes in the flanges. Bolts may have reduced shanks of a diameter not less than the diameter at the root of the threads. Provide high-strength 1/8 inch thick phenolic insulating washers next to the flanges with flat circular stainless steel washers over the insulating washers and under bolt heads and nuts. Provide bolts long enough to compensate for the insulating gaskets and stainless steel washers.

2.3.4 Flange Bolts, Nuts, and Washers

Bolts and nuts for pipe flanges, flanged fittings, valves and accessories shall conform to ASME B18.2.1 and ASME B18.2.2, except as otherwise specified. Bolts shall be regular hexagonal type. Bolts shall be threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes 1 inch and smaller and Eight-Pitch Thread Series for sizes larger than 1 inch. Nuts shall be the hexagonal, heavy series type. Nuts shall be threaded in accordance with ASME B1.1, Class 2B fit, Coarse Thread Series for sizes 1 inch and smaller and Eight-Pitch Thread Series for sizes larger than 1 inch. Bolts shall be of sufficient length to obtain full bearing on the nuts and shall project no more than two full threads beyond the nuts with the bolts tightened to the required torque.

2.3.4.1 Stainless Steel Materials

Bolts shall conform to ASTM A193/A193M, Class 2, Grade 8. Nuts shall conform ASTM A194/A194M, Grade 8. Washers shall conform to ASTM A436, flat circular of the same material as the bolt.

2.3.4.2 Carbon Steel Materials

Bolts shall conform to ASTM A307, Grade B, hot-dipped galvanized. Nuts shall conform to ASTM A563, Grade A, hex style, hot-dipped galvanized. Washers shall conform to ASTM F436 Type 1 (carbon steel), flat circular for carbon steel bolts.

2.4 PIPE

Pipe shall meet the material, fabrication and operating requirements of ASME B31.3, except as modified herein.

2.4.1 Carbon Steel Pipe

Provide carbon steel pipe that complies with one of the following:

a. Pipe shall conform to ASTM A53/A53M, Type E or S, Grade B, seamless or electric welded. Pipe smaller than 2-1/2 inches shall be Schedule 80. Pipe 2-1/2 inches and larger shall be Schedule 40. All exterior piping, subject to ballistic protection requirements, shall be Schedule 80.

b. Pipe shall conform to API Spec 5L, Product Specification Level (PSL) 1, Grade B, submerged-arc welded or gas metal-arc welded .

End connections for pipe or fittings smaller than 2-1/2 inches shall be forged, socket weld type conforming to ASTM A182/A182M and ASME B16.11, unless indicated otherwise. End connections for pipe or fittings 2-1/2 inches and larger shall be buttweld type conforming to ASTM A234/A234M,

Grade WPB and ASME B16.9 of the same wall thickness as the adjoining pipe. Where threaded end connections are indicated, provide connections that conform to ASME B16.3, Class 150 or ASME B16.11.

2.4.2 Stainless Steel Pipe

2.4.2.1 Control Piping, Stainless Steel

Piping shall be seamless, fully annealed stainless steel tubing conforming to ASTM A269/A269M, Grade TP316, with a hardness number not exceeding 80 HRB. For 1/2 inch tubing, provide a minimum 0.049 inch tubing wall thickness.

2.4.2.2 Control Piping Fittings

Fittings shall be the flareless, Type 316 stainless steel type conforming to SAE J514.

2.4.3 Fiberglass Reinforced Plastic (FRP) Pipe

Pipe shall be listed in UL FLAMMABLE & COMBUSTIBLE and be chemically compatible with the fuel to be handled. Fittings, end connections and adhesives shall be listed in UL FLAMMABLE & COMBUSTIBLE and be chemically compatible with the fuel to be handled. Use only adhesives that have not exceeded the manufacturer's recommendations for shelf life and pot life.

2.4.4 Exterior Containment Piping System

Piping system shall be the factory fabricated, double-wall type that conforms to ASME B31.3 and NFPA 30. Product pipe shall be as indicated on the drawings and as specified herein. The exterior containment pipe shall be fiberglass reinforced plastic (FRP) that conforms to ASTM D5677 except as modified herein. Containment pipe shall be chemically compatible with the type of fuel to be handled, be non-corrosive, dielectric, non-biodegradable, and resistant to attack from microbial growth. Containment piping shall be capable of withstanding a minimum 5 psi air pressure. Containment piping and supports shall be designed to allow for drainage of liquids. Containment piping shall allow for complete inspection of the product piping before the containment piping is sealed.

Containment piping shall be evenly separated from the product piping with pipe supports that are designed based on pipe size, pipe and fuel weight, and operating conditions. Pipe supports shall be constructed of the same material as the product pipe. Design supports so that no point loading occurs on the primary or exterior pipe. Supports shall be permanently attached to the product pipe either by tack welding or by an adhesive. Supports shall be designed and installed to allow for pipe movement of both the product piping and the exterior containment piping without causing damage to either.

Low point leak detection of FRP containment piping shall be provided at all applicable low points. The containment pipe shall include a sump and sample valve at the low point locations.

2.5 PIPING COMPONENTS

Provide piping components that meet the material, fabrication and operating requirements of ASME B31.3, except as modified herein. Pressure design class for piping components shall be Class 150 as defined in

ASME B16.5.

2.5.1 Welded Nipples

Nipples shall conform to ASTM A733 or ASTM B687 and be constructed of the same material as the connecting pipe.

2.5.2 Steel Couplings

Couplings shall conform to API Spec 5L, seamless, extra heavy, wrought steel with recessed ends.

2.5.3 Threaded Unions

Unions shall conform to ASME B16.39, Class 150. Unions materials shall conform to ASTM A312/A312M, Grade 304 or 316. Dielectric unions shall conform to dimensional, strength, and pressure requirements of ASME B16.39, Class 150. Steel parts shall be galvanized or plated. Union shall have a water-impervious insulation barrier capable of limiting galvanic current to one percent of the short-circuit current in a corresponding bimetallic joint. When dry, union shall be able to withstand a 600-volt breakdown test.

2.5.4 Joint Compound

Joint compounds shall be resistant to water and be suitable for use with fuel containing 40 percent aromatics.

2.5.5 Flexible Pipe Connector

Connector shall be the flexible, close pitch, metal hose type that is constructed with exterior annular corrugations and provided with a single layer of braided wire sheath covering. Connectors shall be constructed entirely of stainless steel and be rated for the system working pressure and temperature.

2.5.6 Strainer

Strainer shall be the in-line, cleanable, simplex basket type configured in either an "S" or "T" pattern. Strainer body shall be fabricated of cast steel, brass, or Type 304 or 316 stainless steel. Provide strainer with a drain and with drain piping that is inclusive of a ball valve. Strainer shall be equipped with a removable cover, flanged end connections, an air eliminator, ports for connection of differential pressure sensor tube, and arrows clearly cast on the strainer sides that indicate the direction of flow. Strainers shall have a removable, 60 mesh, Type 316 stainless steel wire sediment screen. The ratio of net effective strainer area to the area of the connecting pipe shall be not less than 3 to 1.

2.5.7 Thermometers

Thermometer shall be the analog, dial-type bimetallic actuated type that conforms to ASME B40.200. Thermometer shall have a 5 inches diameter dial, a hermetically sealed stainless steel case, a stainless steel stem, a safety glass face, a fixed threaded connection, and a scale range as indicated. Thermometer accuracy shall be within one percent of the scale range.

2.5.8 Pressure Gauge

Gauge shall be the single style type that conform to ASME B40.100. Gauge shall have a 4-1/2 inches dial, a stainless steel case and tube, a stainless steel ball valve, pressure snubbers, and a scale range as indicated. Gauge shall be liquid-filled with glycerin or silicone. Provide gauge with an adjustable marker arrow that allows a user to mark a specific pressure for future reference.

2.5.9 Pipe Hangers and Supports

Hangers and supports shall be the adjustable type conforming to MSS SP-58, except as modified herein. Provide hot-dipped galvanized finish on rods, nuts, bolts, washers, hangers, and supports. Provide miscellaneous metal that conforms to ASTM A36/A36M, , ASME B31.3, and ASME B31.4; standard mill finished structural steel shapes, hot-dipped galvanized.

2.5.9.1 Pipe Protection Shields

Shields shall conform to MSS SP-58, Type 40, except material shall be Type 316 stainless steel. Provide shields at each slide type pipe hanger and support.

2.5.9.2 Low Friction Supports

Supports must have self-lubricating anti-friction bearing elements composed of 100 percent virgin tetrafluoroethylene polymer and reinforcing aggregates, prebonded to appropriate backing steel members. The coefficient of static friction between bearing elements shall be 0.06 from initial installation for both vertical and horizontal loads and deformation shall not exceed 0.002 inch under allowable static loads. Bonds between material and steel shall be heat cured, high temperature epoxy. Design pipe hangers and support elements for the loads applied. Provide anti-friction material with a minimum of 0.09 inch thick. Provide hot-dipped galvanized steel supports. Provide supports that are factory designed and manufactured.

2.5.10 Escutcheon

Escutcheon must be the chrome plated, stamped steel, hinged, split ring type. Inside diameter shall closely fit pipe outside diameter. Outside diameter shall completely cover the corresponding floor, wall, or ceiling opening. Provided each escutcheon with necessary set screws.

2.5.11 Flexible Ball Joint

Joint must be the carbon steel type with chromium plated steel balls capable of 360 degree rotation plus 15 degree angular flex movement. Provide joints with flanged end connections and pressure molded composition gaskets designed for continuous operation at operating conditions.

2.5.12 Bellows Expansion Joint

Joint shall be the bellows expansion type with internal sleeves, external protective covers, and flanged end connections. Bellows shall be corrugated, Type 304 stainless steel with reinforced rings. Joints shall be provided with limit stops to limit total movement in both directions. Joints shall be capable of withstanding 10,000 cycles over a period of 20

years.

2.5.13 Sight Flow Indicator

Indicator shall be constructed of stainless steel and be provided with flanged end connections. Indicator shall include an internal rotating propeller to provide visual flow indication. Indicator housing shall include a tempered glass observation port for viewing the rotating propeller. Indicator shall have Buna-N seals.

2.5.14 Fuel Oil Meter

Provide volumetric positive displacement type meter that conforms to ASTM F1172, except as modified herein. Meter shall indicate the fuel oil flow rate in gpm. Meter shall be provided with overspeed protection and a water escape hole. If meter is not mounted in-line with the piping, then an appropriate pedestal for mounting shall be provided. Install meter in accordance with manufacturer's recommendations. Meter shall be capable of providing a 4-20 mA analog output signal for the fuel flow rate. The output signals shall be compatible with the base's existing Energy Monitoring and Control, System (EMCS). The meter shall also locally display a totalized and resettable total gallons flow value.

2.5.15 Vent Cap

Provide atmospheric, updraft type cap. Cap shall be constructed of aluminum or carbon steel. Cap shall have an internal brass or bronze insect screen, minimum 40-mesh. Cap shall prevent rain, snow, or ice from entering the vent piping.

2.6 GENERAL VALVES

Provide valves that meet the material, fabrication and operating requirements of ASME B31.3, except as modified herein. **AM#6...**Valves shall meet UL842 (Standard for Valves for Flammable Fluids) requirements. Valves smaller than 2 inches shall have socket weld or threaded end connections. **...AM#6**Valves **AM#6...**2 inches and larger **...AM#6**shall have flanged end connections and conform to ASME B16.34, Class 150 except as modified herein. Provide stainless steel stem and trim for each valve. Valves shall have a weatherproof housing. Seats, body seals, and stem seals shall be Viton or Buna-N.

a. Carbon Steel Piping. Provide valves with bodies, bonnets, and covers constructed of cast steel conforming to ASTM A216/A216M.

b. Stainless Steel Piping. Provide valves with bodies, bonnets, and covers constructed of stainless steel conforming to ASTM A743/A743M, Type 304 or 316; or cast steel conforming to ASTM A216/A216M, Grade WCB internally plated with nickel or internally electrodeless nickel plated.

2.6.1 Swing Type Check Valve

Valve shall be the full-opening, tilting disc, non-slam, swing type**AM#6....** Valves larger than 2 inches shall conform **...AM#6** to API Spec 6D. Discs and seating rings shall be renewable without removing from the line. The disc shall be guided and controlled to contact the entire seating surface.

2.6.2 Wafer Type Check Valve

Valve shall be the dual-plate, double flanged, wafer type**AM#6...**. Valves larger than 2 inches shall conform **...AM#6**to API Std 594. Wafer type check valves may be provided in lieu of swing check valves in piping sizes larger than 4 inches. Valve disc shall be constructed of ASTM A351/A351M, Grade CF8M stainless steel. Valve spring, hinge pin, stop pin, and radial-thrust bearing materials shall be constructed of Type 316 stainless steel.

2.6.3 Ball Valve

Valve shall be the non-lubricated, double seated, ball type that conforms to API Spec 6D. Valve shall operate from fully open to fully closed with 90 degree rotation of the ball. Valve shall be capable of 2-way shutoff. Valve ball shall be constructed of stainless steel. For valves 2 inches and larger, provide full bore type. Valves smaller than 2 inches shall have one piece bodies and shall have a minimum bore not less than 55 percent of the internal cross sectional area of a pipe of the same nominal diameter. Balls shall be provided with trunnion type support bearings for valves 14 inches and larger. Provide valves with worm gear operators, except valves 6 inches and smaller may be lever operated with a minimum 10 adjustable positions between fully opened and fully closed.

2.6.4 Globe Valve

Conform to ASME B16.34, Class 150.

2.6.5 Plug Valve (PTFE Sleeved Tapered Type)

Valve must be the non-lubricated, PTFE sleeved tapered plug type that conforms to API Spec 6D. Valve shall have 360 degree port defining lips to retain the sleeve against deforming into the flow passages. Valve shall provide abrasion protection and shall prevent fuel entry behind the sleeve. Plug shall operate with a 90 degree turn for closure. For valves installed in loop or distribution piping, provide valve body with a body cavity drain connection.

2.6.6 Plug Valve (Double Block and Bleed Type)

Valve shall be the non-lubricated, resilient, double seated, trunnion mounted type with a tapered lift plug capable of 2-way shutoff that conforms to API Spec 6D. Valve shall have electroplated nickel interiors. Valve plug shall be constructed of steel or ductile iron with electroplated nickel that is supported on upper and lower trunnions. Valve sealing slips shall be constructed of steel or ductile iron with Viton seals. Valve design shall permit sealing slips to be replaced from the bottom with the valve mounted in the piping. Minimum bore size shall be 65 percent of the internal cross sectional area of a pipe of the same nominal diameter, unless the manufacturer can show an equivalent or greater flow rate with a lower percent internal cross sectional area. Valves 6 inches and larger shall have removable lower and bonnet (upper) bushing. Valve shall have weatherproof, worm gear operators with mechanical position indicators. Indicator flag and shaft shall be made of steel.

2.6.6.1 Valve Operation

Valve shall operate from fully open to fully closed by rotation of the

handwheel to lift and turn the plug. Maximum number of turns from full close to full open shall be eight. Rotation of the plug toward open shall lift the plug without wiping the seals and retract the sealing slips so that clearance is maintained between sealing slips and valve body. Rotation of the handwheel toward closed shall lower the plug after sealing slips are aligned with the valve body and force the sealing slips against the valve body for positive closure. When valve is closed, slips shall form a secondary fire-safe metal to metal seat on both sides of the resilient seal.

2.6.6.2 Pressure Relief

Provide plug valve with an automatic thermal relief valve(s) to relieve pressure buildup in the internal body cavity when the plug valve is closed. Relief valve shall open at a 25 psi differential pressure, and discharge to the throat of and to the upstream side of the plug valve.

2.6.6.3 Bleed Valve

Provide a manually operated bleed valve for each plug valve in order to verify that the plug valve is not leaking when in the closed position. Provide discharge piping so that released liquid from each bleed valve can be contained.

2.6.7 Pressure Relief Valve

Valve shall be the fully enclosed, spring loaded, angle pattern, ball seated type with lift lever. Valve shall have corrosion-resistant valve seats. Valve stem shall be fully guided between the fully opened and fully closed positions. Valve shall be factory set to open at the indicated pressure (plus or minus ten percent deviation). Valve setpoint shall be field adjustable within a minimum range of plus or minus 20 percent of the indicated setpoint.

2.6.8 Pressure\Vacuum Relief Valve

Valve shall be the pressure\vacuum vent relief type that conforms to NFPA 30. Valve pressure and vacuum relief settings shall be set at the factory. Pressure and vacuum relief shall be provided by a single valve. Valve body shall be constructed of either cast steel or aluminum. Valve trim shall be stainless steel. Inner valve pallet assemblies shall have a knife-edged drip ring around the periphery of the pallet to preclude condensation collection at the seats. Pallet seat inserts shall be of a material compatible with the fuel specified to be stored. Valve intake shall be covered with a 40 mesh stainless steel wire screen.

2.6.9 Foot Valve

Valve shall be the self-activating, double-poppet, shutoff type that prevents fuel flow from reversing. Valve shall conform to NFPA 30. Valve body shall be constructed of either cast steel or aluminum. Valve shall be provided with a minimum 20 mesh stainless steel screen on the intake. Valve seats shall be the replaceable type. Valve shall be capable of passing through a 3 inches pipe or tank flange.

2.6.10 Tank Overfill Prevention Valve

Valve shall be the two-stage, float-activated, shutoff type that is an integral part of the drop tube used for gravity filling. The first stage

shall restrict the flow of fuel into the tank to approximately 5 gpm when the liquid level rises above 90 percent of tank capacity. The second stage shall completely stop the flow of fuel into the tank when the liquid level rises above 95 percent of tank capacity. Valve shall be constructed of the same material as the fill tube.

2.6.11 Backpressure Control Valve

Valve shall be installed so that the fuel lines maintain backpressure on fuel oil day tanks. Valves shall be sized and selected for intended service.

2.6.12 Fuel System Dry Break Valves

Valves shall be provided for quick connect/disconnect between fuel system piping and local fuel oil delivery service. Valves shall be compatible with fuel and equipment currently utilized for the installation. Valves shall include ball valve isolation.

2.6.13 Anti-Siphon Valve

Provide anti-siphon valve on fuel tank suction lines. Valve shall be aluminum body and compatible with fuel used. Internal pressure relief shall be set to operate between 20 and 40 psi. Valve shall be sized and selected for the intended fuel tank service.

2.6.14 Fusible Link Valve

Provide fusible link valves where called for on fuel oil supply lines. Valves shall include a fusible element integrated into the hand-wheel that will melt at 165 degrees F, causing the valve to close. 10 psi operating pressure for 1/4-inch to 3/4-inch sizes, 25 psi maximum operating pressure for 1-inch size. Body, bonnet, and stem: Brass construction. Valves shall be UL listed and tested for fuel oil system use and shall automatically close if the link melts.

2.7 PUMPS

Pumps shall be driven by an explosion-proof motor for Class I, Division l, Group D hazardous locations as defined in NFPA 70. Pump assemblies shall be statically and dynamically balanced for all flow rates from no flow to 120 percent of design flow. Pump motors shall be non-overloading throughout their entire pump curve.

Coordinate motor enclosure types with HEMP protection requirements (see Section 13 27 54.01 10 HEMP PROTECTION SUBSYSTEMS) for fuel forwarding pumps.

2.7.1 Rotary Pumps

Rotary Pumps shall conform to API Std 676, Mount pump and driver on extended base plate. Motor starters on pumps shall be lockable. The pumps shall be capable of continuously delivering their rated capacity at a pump efficiency of not less than 50 percent. The size of the pump and the operating speed shall be as recommended by the manufacturer for the specified operating conditions and viscosity.

2.7.2 Pump Control Panel

Panel shall include on and off indication lights for each pump. Panel shall contain an adjustable control logic for pump operation in accordance with the indicated operation. Panel shall also have a manual override switch for each pump to allow for the activation or deactivation of each pump.

2.8 FUEL POLISHING SYSTEM

Fuel polishing system shall be FM-approved, NFPA-compliant system to remove particulate through 1 micron and 99.5 percent of water from stored diesel fuel. Filtration shall consist of multiple stages:

Stage 1: 100 wire mesh strainer (149-micron element).

Stage 2: 10-micron particulate removal (spin on filter).

Stage 3: 3-micron particulate removal (spin on filter).

Stage 4: Water separation and removal (element type).

Stage 5: 1-micron particulate removal (element type).

Fuel polishing system shall include an integrated control panel. Filter enclosure shall include complete FTI assembly housed in a two-door cabinet, coated with zinc primer to prevent corrosion and a powder coat finish, manufactured to NEMA 3R standards and designed for rack or wall mounting. Doors shall be removable. Electrical connection shall be 208 to 230 VAC, single-phase, 60 Hz, 15 amps. The fuel polishing system shall be installed per manufacturer's recommendations.

2.9 FRP CONTAINMENT SUMP

Sump shall be constructed of fiberglass reinforced plastic (FRP) that is chemically compatible with the fuels to be handled. Do not connect sump in any way to the manway cover or concrete above. Cap the top of each containment sump with a watertight access cover. Construct cover of the same material as the sump. Cover shall have a minimum diameter of 22 inches. Cover shall be easily removable through the manway above.

a. Rainfall drainage shall not drain into a sump. Sump shall be capable of withstanding underground burial loads to be encountered. Container shall have a minimum 5 gal fuel storage capacity. Container shall not contain any type of drain.

b. The sides of a containment sump shall allow the penetration of carrier pipes, exterior containment pipes, conduits, and vapor pipes as required. Boot or seal penetrations in the containment sump sides to ensure that liquid will not escape from the sump in the event that the liquid level within the sump rises above the pipe penetration. Provide boots and seals that are chemically compatible with the fuel to be handled and that are water resistant to the influx of ground water. Boots and seals shall be designed and installed to accommodate the anticipated amount of thermal expansion and contraction in the piping system.

2.10 ACCESSORIES

2.10.1 Concrete Anchor Bolts

Concrete anchors shall conform to ASTM A307, Grade C, hot-dipped galvanized.

2.10.2 Bolts and Studs

Carbon steel bolts and studs shall conform to ASTM A307, Grade B, hot-dipped galvanized. Stainless steel bolts and studs shall conform to ASTM A193/A193M, Class 2, Grade 8.

2.10.3 Nuts

Carbon steel nuts shall conform to ASTM A563, Grade A, hex style, hot-dipped galvanized. Stainless steel nuts shall conform to ASTM A194/A194M, Grade 8.

2.10.4 Washers

Provide flat circular washers under each bolt head and each nut. Washer materials shall be the same as the connecting bolt and nut. Carbon steel washers shall conform to ASTM F844, hot-dipped galvanized. Stainless steel washers shall conform to ASTM A194/A194M, Grade 8.

2.10.5 Polytetrafluoroethylene (PTFE) Tape

Tape shall conform to ASTM D3308.

2.10.6 Pipe Sleeves

Provided sleeves constructed of hot-dipped galvanized steel, ductile iron, or cast-iron pipe .

2.10.7 Buried Utility Tape

Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in minimum 3 inches width rolls, color coded for the utility involved, with warning identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning identification shall be at least 1 inch high and shall state as a minimum "BURIED FUEL PIPING BELOW". Provide permanent code and letter coloring that is unaffected by moisture and other substances contained in trench backfill material.

2.11 FINISHES

Ship, store, and handle coating materials as well as apply and cure coatings in accordance with SSPC PA 1.

2.11.1 Exterior Coating, Aboveground Piping

Coat the exterior of aboveground steel piping, flanges, fittings, nuts, bolts, washers, valves, and piping components, as defined in this specification, in accordance with Section 33 52 80.01 00 POL PIPELINE COATING SYSTEMS.

2.11.2 New Equipment and Components

2.11.2.1 Factory Coating

Unless otherwise specified, provide equipment and components fabricated from ferrous metal with the manufacturer's standard factory finish. Each factory finish shall withstand 500 hours exposure to the salt spray test specified in ASTM B117. For test acceptance, the test specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark immediately after completion of the test. For equipment and component surfaces subject to temperatures above 120 degrees F, the factory coating shall be appropriately designed for the temperature service.

2.11.2.2 Field Painting

Painting required for surfaces not otherwise specified shall be field painted as specified in Section 33 52 80.01 00 POL PIPELINE COATING SYSTEMS. Do not paint stainless steel and aluminum surfaces. Do not coat equipment or components provided with a complete factory coating. Prior to any field painting, clean surfaces to remove dust, dirt, rust, oil, and grease.

PART 3 EXECUTION

3.1 INSTALLATION

Installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.3 and NFPA 30, except as modified herein. Safety rules as specified in NFPA 30 shall be strictly observed. Never direct bury threaded connections, socket welded connections, unions, flanges, valves, air vents, or drains. Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible.

3.1.1 Pumps

Properly level, align, and secure pumps in place in accordance with manufacturer's instructions. Support, anchor, and guide so that no strains are imposed on a pump by weight or thermal movement of piping. Provide floor-mounted pumps with mechanical vibration isolators or a vibration isolation foundation.

3.1.2 Piping

3.1.2.1 General

Thoroughly clean pipe of all scale and foreign matter before the piping is assembled. Cut pipe accurately to measurements established at the jobsite, and worked into place without springing or forcing. Cut pipe square and have burrs removed by reaming. Install pipe to permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted without written approval.

a. Use reducing fittings for changes in pipe sizes. Install equipment and piping into space allotted and allow adequate acceptable

clearances for installation, replacement, entry, servicing, and maintenance. Provide electric isolation fittings between dissimilar metals. Install piping straight and true to bear evenly on supports. Piping shall be free of traps, shall not be embedded in concrete pavement, and shall drain as indicated. Make changes in direction with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. Mitering or notching pipe or other similar construction to form elbows or tees will not be permitted.

b. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted. When work is not in progress, securely close open ends of pipe and fittings with an expandable pipe plug so that water, earth, or other substances cannot enter the pipe or fittings. For belowground piping, the full length of each pipe shall rest solidly on the underlying pipe bed.

3.1.2.2 FRP Piping

Install FRP pipe in accordance with manufacturer's instructions.

3.1.2.3 Exterior Containment Piping System

Install exterior containment piping in accordance with manufacturer's instructions. Do not assemble joints in an exterior containment piping system until the successful completion of the tests defined in paragraph FIELD QUALITY CONTROLS.

3.1.2.4 Welded Connections

Unless otherwise indicated on the drawings, pipe joints shall be welded. Construct branch connections with welding tees or forged welding branch outlets. Do not weld stainless steel pipe to carbon steel pipe.

3.1.2.5 Threaded End Connections

Provide threaded end connections only on piping 2 inches in nominal size or smaller and only where indicated on the drawings. Provide threaded connections with PTFE tape or equivalent thread-joint compound applied to the male threads only. Not more than three threads shall show after the joint is tighten.

3.1.2.6 Brazed Connections

Provide brazing in accordance with AWS BRH, except as modified herein. During brazing, fill pipe and fittings with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Before brazing copper joints, clean both the outside of the tube and the inside of the fitting with a wire fitting brush until the entire joint surface is bright and clean. Do not use brazing flux. Remove surplus brazing material at all joints. Support piping prior to brazing and do not be spring or force piping.

3.1.2.7 Existing Piping Systems / Coordination Between Design Packages

No interruptions or isolation of an existing fuel handling service or system shall be performed unless the actions are approved by the Contracting Officer. Perform initial cutting of existing fuel pipe with a

multiwheel pipe cutter, using a nonflammable lubricant. After cut is made, seal interior of piping with a gas barrier plug. Purge interior of piping with carbon dioxide or nitrogen prior to performing any welding process.

3.1.3 Bolted Connections

For each bolted connection of stainless steel components (e.g., pipes, piping components, valves, and equipment) use stainless steel bolts or studs, nuts, and washers. For each bolted connection of carbon steel components, use carbon steel bolts or studs, nuts, and washers. Extend bolts, or studs, no less than two full threads beyond their corresponding nut when tightened to the required torque. Prior to installing nuts, apply a compatible anti-seize compound to the male threads.

3.1.4 Flanges and Unions

Except where threaded end connections and/or unions are indicated, provide flanged joints in each line immediately preceding the connection to a piece of equipment or material requiring maintenance such as pumps, general valves, control valves, strainers, and other similar items and as indicated. Assemble flanged joints square and tight with matched flanges, gaskets, and bolts. Use flanged connections between FRP pipe and metal pipe with the metal pipe anchored within 5 ft of the connection. For flanges, provide washers under each bolt head and nut. Torque wrenches shall be used to tighten all flange bolts to the torque recommended by the gasket manufacturer. Tightening pattern shall be as recommended by the gasket manufacturer. Use anti-seize compound on threads for stainless steel bolts.

3.1.5 Valves

Install isolation plug or ball valves on each side of each piece of equipment, at the midpoint of looped mains, and at any other points indicated or required for draining, isolating, or sectionalizing purpose. Install valves with stems vertically up unless otherwise indicated. Provide individual supports and anchors for each valve.

3.1.6 Air Vents

Provide 2-inch air vents at all high points and where indicated to ensure adequate venting of the piping system.

3.1.7 Sight Flow Indicator

Mount indicator rolled one bolt hole to prevent freeze damage from rainwater accumulation on viewing window. Install a sight flow indicator downstream of each relief valve.

3.1.8 Drains

Provide 1-1/2-inch drains at all low points and where indicated to ensure complete drainage of the piping. Drains shall be accessible, and shall consist of nipples and caps or plugged tees unless otherwise indicated.

3.1.9 Flexible Pipe Connectors

Attach connectors to components in strict accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint.

Hangers, when required to suspend the connectors, shall be of the type recommended by the flexible pipe connector manufacturer and shall be provided at the intervals recommended.

3.1.10 Bellows Expansion Joints

Cold set joints to compensate for the temperature at the time of installation. Provide initial alignment guides on the connecting piping no more than 4 pipe diameters from the expansion joint. Provide additional alignment guides on the connecting piping no more than 14 pipe diameters from the first guide.

3.1.11 Thermometers

Provide thermometers with separable sockets. Install separable sockets in pipe lines in such a manner to sense the temperature of flowing fluid and minimize obstruction to flow.

3.1.12 Pipe Sleeves

Provide a pipe sleeve around any pipe that penetrates a wall, floor, or crosses under a roadway. Do not install sleeves in structural members except where indicated or approved. Install pipe sleeves in masonry structures at the time of the masonry construction. Sleeves shall be of such size as to provide a minimum of 1/2 inch all-around clearance between bare pipe and the sleeve. Align sleeve and piping such that the pipe is accurately centered within the sleeve by a nonconductive centering element. Securely anchor the sleeve to prevent dislocation. Closure of the space between the pipe and the pipe sleeve shall be by means of a mechanically adjustable segmented elastomeric seal. The seal shall be installed so as to be flush. For wall or floor penetrations, extend each sleeve through its respective wall or floor and cut flush with each surface. For roadway crossings, pipe sleeves shall be continuous for the entire crossing as well as extend a minimum of 6 inches beyond both sides of the crossing. Seal around sleeves that penetrate through valve or fuel related pits with a Buna-N casing seal. Seal around sleeves that penetrate through non-fire-rated walls and floors in accordance with Section 07 92 00.01 00 JOINT SEALANTS. Seal around sleeves that penetrate through fire-rated walls and floors as specified in Section 07 84 00.01 00 FIRESTOPPING.

3.1.13 Escutcheons

Except for utility or equipment rooms, provide finished surfaces where exposed piping pass through floors, walls, or ceilings with escutcheons. Secure escutcheon to pipe or pipe covering.

3.1.14 Access Panels

Provide access panels for all concealed valves, vents, controls, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Provide access panels as specified in Section 05 50 13.01 00 MISCELLANEOUS METAL FABRICATIONS.

3.1.15 Buried Utility Tape

Bury tape with the printed side up at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

3.1.16 Framed Instructions

Framed instructions shall include equipment layout, wiring and control diagrams, piping, valves, control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. Frame under glass or laminated plastic the framed instructions and post where directed by the Contracting Officer. Post the framed instructions before the system performance tests.

3.2 PIPE HANGERS AND SUPPORTS

Install hangers with a maximum spacing as defined in Table 1 below, except where indicated otherwise. In addition to meeting the requirements of Table 1, provide additional hangers and supports where concentrated piping loads exist (e.g., valves). Install supports so that the bottom of the pipe is a minimum of 18 inches above the ground surface or higher if required to service valves and equipment.

Table 1. Maximum Hanger Spacing

Nominal Pipe Size (Inches)	One and Under	1.5	2	3	4	6	8	10	12
Maximum Hanger Spacing (ft)	7	9	10	12	14	17	19	22	23

3.2.1 Seismic Requirements

Support and brace piping and attach valves to resist seismic loads as specified under Sections 13 48 00.01 00 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 13 48 00.01 00 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT and as shown on the drawings. Structural steel required for reinforcement to properly support piping, headers, and equipment but not shown shall be provided under this section. Material used for support shall be as specified under Section 05 12 00.01 00 STRUCTURAL STEEL.

3.2.2 Structural Attachments

Provide attachments to building structure concrete and masonry by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Apply inserts and anchors with a safety factor not less than 5. Do not attach supports to metal decking. Construct masonry anchors for overhead applications of ferrous materials only. Structural steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material used for support shall be as specified under Section 05 12 00.01 00 STRUCTURAL STEEL.

3.3 FIELD QUALITY CONTROLS

3.3.1 System Commissioning

System commissioning shall conform to Section 33 08 55.01 00 COMMISSIONING OF POL FACILITY SYSTEMS.

3.3.2 Tests

Furnish labor, materials, equipment, electricity, repairs, and retesting necessary for any of the tests required herein. Perform piping test in accordance with the applicable requirements of ASME B31.3 except as modified herein. To facilitate the tests, various sections of the piping system may be isolated and tested separately. Where piping sections terminate at flanged valve points, close the line by means of blind flanges in lieu of relying on the valve. Provide tapped flanges to allow a direct connection between the piping and the air compressor and/or pressurizing pump. Use tapped flanges for gauge connections. Taps in the permanent line will not be permitted. Gauges will be subject to testing and approval. Provide provisions to prevent displacement of the piping during testing. Keep personnel clear of the piping during pneumatic testing. Only authorized personnel shall be permitted in the area during pneumatic and hydrostatic testing. Isolate equipment such as pumps, tanks and meters from the piping system during the testing. Do not exceed the pressure rating of any component in the piping system during the testing. Following satisfactory completion of each test, relieve the test pressure and seal the pipe immediately. Piping to be installed underground shall not receive field applied exterior coatings at the joints or be covered by backfill until the piping has passed the final pneumatic tests described herein.

3.3.2.1 Exterior Coating Holiday Test

Following installation, test the exterior coating of direct buried piping for holidays using high-voltage spark testing in accordance with NACE SP0188. Repair holidays and retest to confirm holiday-free coating. Text shall include all existing underground piping exposed for this project.

3.3.2.2 Hydrostatic Test

Hydrostatically test product piping with the fuel to be handled to the lesser of 1-1/2 times operating pressure or 275 psig in accordance with API RP 1110. Maintain the pressure within the piping for 4 hours with no leakage or reduction in gauge pressure. If leaks are discovered, repair the leaks accordingly and retest.

3.3.2.3 Exterior Containment Piping Tests

Apply a minimum pneumatic pressure of 5 psig to the exterior containment piping. Maintain the pressure for at least 1 hour while soapsuds or equivalent materials are applied to the exterior of the piping. While applying the soapsuds, visually inspect the entire run of piping, including the bottom surfaces, for leaks (bubble formations). Repair leaks discovered in accordance with manufacturer's instructions and retest. Perform testing in compliance with the manufacturer's published installation instructions.

3.4 SYSTEM PERFORMANCE TESTS

Conform tests to Section 33 08 55.01 00 COMMISSIONING OF POL FACILITY SYSTEMS.

3.5 DEMONSTRATIONS

Conduct a training session for designated Government personnel in the operation and maintenance procedures related to the equipment/systems specified herein. Include pertinent safety operational procedures in the session as well as physical demonstrations of the routine maintenance operations. Furnish instructors who are familiar with the installation/equipment/systems, both operational and practical theories, and associated routine maintenance procedures. The training session shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed, but prior to final system acceptance. Submit a letter, at least 14 working days prior to the proposed training date, scheduling a proposed date for conducting the onsite training.

-- End of Section --